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(54) Omnidirectional light.

(57) An omnidirectional (360°) light is provided comprising a fixed, unidirectional light source (29) (including IR and UV sources as well as visible light) providing a unidirectional incident light beam (36) incident upon two or more, oppositely directed reflective surfaces (22,24) on a rotatable reflector (18) and inclined to the incident beam, preferably at 45°, to provide two or more reflected beams, directed radially away from the axis of rotation of the reflector and radially spaced one from the other at preferably 180°. Four or more reflective surfaces may be used to provide, for example, four reflected beams at 90° to each other. The reflector (18) is rotatable at high speed about the axis of rotation by a motor to cause the reflected beams each to sweep a 360° arc about the axis of rotation, the speed of rotation being such that the light appears continuous.

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This invention relates to a directional (360°) light having a single, stationary unidirectional light source.

Whilst the invention is primarily applicable to, and will be described with reference to, an omnidirectional (360°) light source capable of emitting,over a 360° arc, electromagnetic radiation falling in the visible range of the electromagnetic spectrum, the principles described herein will be applicable to the distribution of ultraviolet, infrared and other electromagnetic radiation over a 360° arc from a single unidirectional source capable of emitting radiation of the appropriate wavelength. Except, therefore, where the context clearly requires a visible light source, i.e. a source of electromagnetic radiation falling within the visible region of the electromagnetic spectrum, the terms "light" and "light source" are to be construed generically as covering electromagnetic radiation, and sources thereof, of wavelengths falling outside the visible spectrum as well as within.

Conventional light bulbs are omnidirectional, but their illumination is not intense beyond a short distance. In order to provide a light that would cast its illumination over greater distances, inventors developed flashlights and spotlights. These devices focus the light beam so that it travels over greater distances, but the omnidirectionality of the light is lost.

Accordingly, a number of inventors developed light fixtures having focused beams that would spin about an axis at a high rate of speed. These fast spinning lights were the first to provide omnidirectional lighting beyond the capabilities of a fixed position light source, but the mechanical forces acting upon the bulbs shortened the lifetime of such spinning bulbs and made then unacceptable.

In U.S.-A-4,054,791 there is described a portable lantern comprising a mirror mounted at a forty five degree angle relative to an incident light beam from a fixed source and which is rotatable at high speed about an axis coincident with the light beam. The result is a fast-spinning spotlight beam that provided an intense omnidirectional light, i.e. encompassing an arc of 360° about the axis of rotation. It has been determined, however, that a rapidly rotating mirror positioned at a forty five degree angle is subject to rotational problems because of the inherent instability of a flat, planar article mounted at a forty five degree angle. Thus, at high speeds of rotation, vibration appears and greater rotational speeds cannot be obtained.

Thus, there is a need for an omnidirectional light that is not subject to vibration-related problems, but the prior art neither teaches nor suggests how such an instrument could be provided.

In accordance with the present invention, this is provided by a unique construction of rotatable reflectors comprising two or more reflective surfaces positioned at an angle to the incident beam and serving to split that beam into two or more reflected beams radially spaced from one another about the axis of rotation, thereby to provide, as the reflector is driven at high speed about its axis, a plurality of reflected light beams each sweeping a 360° arc and being radially spaced one from the other. In the preferred arrangement two reflective surfaces are provided, each at 45° to the incident light beam but directed at 180° from each other. Such an arrangement is effective to split the incident light beam into two rotating reflected light beams at a radial spacing of 180° to each other.

In other words two reflective surfaces, or mirrors, are provided which form an "X" configuration when seen in side elevation. This enables the mirrors to rotate at half the speed of a single reflector to produce the same quantity of omnidirectional illumination. Perhaps more importantly, this "X" configuration of reflectors is perfectly balanced. Accordingly, the rate of revolution can be much higher than rotating mirror lamps of the type described in US-A-4,054,791 with the result that the intensity of the light is appreciably greater in all directions when a similar light source is used.

Preferably the rotatable reflector is essentially symmetrical on both sides of the axis of rotation, thereby to provide a balanced reflector substantially free from problems of vibration when rotated about that axis.

For a fuller understanding of the invention, reference should be made to the following detailed description, taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of a first embodiment of the invention;

Fig. 2 is an enlarged, partially cut away view of the apparatus of Fig. 1;

Fig. 3 is a sectional view taken along line 3-3 in Fig. 2;

Fig. 4 is a perspective view of the novel mirrors at a selected position of rotational adjustment;

Fig. 5 is a view similar to Fig. 4, showing the mirrors in a second position of rotational adjustment;

Fig. 6 is a view similar to Figs. 4 and 5, showing the mirrors in a third selected position of rotational adjustment;

Fig. 7 is a side elevational and partially sectional view of a second embodiment of the invention;

Fig. 8 is a side elevational, partially cut away view of the third embodiment;

Fig. 9 is a side elevational, partially cut away view of a fourth embodiment;

Fig. 10 is a side elevational, partially cut away view of a fifth embodiment with the mirrors in a first position of rotational adjustment;

Fig. 11 is a view similar to Fig. 10, but showing the mirrors rotated one hundred and eighty degrees from the Fig. 10 position;

Fig. 12 is a side elevational, partially cut away

view of a sixth embodiment;

Fig. 13 is a side elevational view of a marker buoy having utility in connection with the novel apparatus;

Fig. 14 is a side elevational view of land-mounted buoy;

Fig. 15 is a side elevational view of the buoy mounted in shall waters;

Fig. 16 is an enlarged side elevational view of an embodiment of the invention in the form of a street light;

Fig. 17 is a partial side elevational view of the street light, a part of which is enlarged in Fig. 16;

Fig. 18 is a front elevational view of the lamp part of said street light:

Fig. 19 is a side elevational view of a house equipped with still another embodiment of the present invention;

Fig. 20 is an enlarged, detailed view of the motor-driven reflectors shown in Fig. 19;

Fig. 21 is a front elevational view of a police car light fixture;

Fig. 22 is a sectional view taken along line 22-22 in Fig. 21;

Fig. 23 is an elevational view of a remote control pad having utility in connection with all embodiments of the present invention; and

Figs. 24-38 show prisms having utility in connection with the several embodiments of the invention.

Referring now to Fig. 1, it will there be seen that a hand held prototype embodiment of the present invention is denoted by the reference numeral 10 as a whole.

Device 10 includes a handle 12 of the type having a battery-operated motor 14 affixed thereto, as in power screw drivers, e.g. activation of switch 16, having directional arrows thereon, causes the output shaft, not shown, of motor 14 to rotate in a predetermined direction dependent upon the direction of rocking of said switch as is well known.

A base member 18 of unique construction is suitably secured as at 20 to the output shaft and is therefore conjointly rotatable therewith. Base 18 has two oppositely inclined surfaces, each of which supports a mirror. More particularly mirrors 22 and 24 are disposed orthogonally with respect to one another and at forty five degrees angles relative to the axis of rotation of the output shaft.

A transparent cylindrical housing 26 keeps dust off the mirrors and does not rotate. It also serves as a mounting means for flashlight 28, as perhaps best understood in connection with Fig. 2. Flashlight 28 includes a reflector 27 and a bulb 29. A boss 30 is centrally apertured as at 32 (Fig. 1) to receive the leading end of the flashlight and housing 26 is also suitably apertured as at 34 to admit light into the housing, as indicated by the arrows collectively denoted 36 in Fig. 2.

It should be clear from Fig. 2 that the light beams are directed in opposite directions in a plane substantially orthogonal to the axis of symmetry of the light beams.

The splitting of the beam may be better understood in connection with Figs. 3-6, where the mirrors are shown in plan view (Fig. 3) and in different rotational positions (Figs. 4-6).

A larger and somewhat less portable prototype of the novel motion light is shown in Fig. 7 and is denoted 40 as a whole.

The embodiment of Fig. 7 includes a hollow base 42, a motor 44 mounted therewithin, motor 44 having output shaft 46 that carries pulley 47, an upstanding, rotatably mounted central axle member 48 having axis of rotation 49, a pulley 50 carried thereby, a belt 52 for interconnecting pulleys 47 and 50, pillow bearings 51, a first mirror 54, a second mirror 56, a transparent, preferably cylindrical housing 58 for said mirrors, and a high intensity lamp 60 that receives line current through cord 62.

Those skilled in the art of machine design will appreciate that there are numerous means equivalent to the depicted belt and pulley apparatus for causing vertical axle 48 to rotate about its axis 49. Various gear arrangements, direct drives, and the like could be employed, for example.

Moreover, housing 58 need not be cylindrical in configuration and may instead take any predetermined geometrical configuration. It need not be provided at all if no care is taken to keep mirrors 54, 56 clean.

Lamp 60 is preferably a zenon gas filament or short - arc light sources which are commercially available from a variety of manufacturers.

Mirrors 54, 56 are mounted on base 64 that is conjointly rotatable with axle 48. Base 64 includes first flat surface 66 that is disposed at a forty five degree angle relative to axis 49 and second flat surface 68 that is disposed orthogonally to said first surface 66, i.e. it is also disposed forty five degrees relative to axis 49 but is sloped in an opposite direction relative to said first surface 66.

Mirrors 54, 56 are fixedly secured to their respective mounting surfaces 66, 68 by any suitable means such as screws 67.

Light emanating from lamp 60 is split by mirrors 54, 56 into two equal intensity beams, just as in the first embodiment.

Both motor 44 and lamp 60 operate on 12 volts; accordingly, this embodiment may be used in a variety of mobile applications including marine, auto and aircraft or for all types of stationary exterior or stand alone interior lighting applications. Motor 44 rotates at 1,800 R.P.M.s under load and has a gear ration of 1 to 2, thereby rotating axle 48 and the mirrors at 3,600 R.P.M. However, the novel arrangement of mirrors

doubles the number of light pulses and thus has an effective rotational speed of 7,200 R.P.M. or 120 revolutions per second. Thus, the human eye is unable to perceive any discontinuities in the illumination.

Preferably light source 60 is a collimated light source providing, for example, six million candle power. A light of this intensity will illuminate over 7.8km² at nearly the same intensity, in any one degree of the beam's 360 degrees of travel. The area illuminated is over one thousand times that of the unaided light source 60 and the lighting efficiency is nearly six hundred and fifty times that of said light source.

Another portable version of the novel motion lamp is depicted in Fig. 8 and is denoted 70 as a whole. A bulb and a reflector are housed in dome 72. Threaded flange 74, having a O-ring seal (not shown), joins dome 72 and transparent, cylindrical housing 76. Base 78 in this embodiment is a molded, one-piece plastic part. A vacuum-applied reflective coating is applied to the respective angled surfaces 77, 79 thereof.

A red-tinted shroud, shown in its retracted configuration, is attached to and conjointly movable with slide knob 80 that slides back and forth in slot 82 when manipulated by the operator of the novel light. Accordingly, sliding knob 80 in the direction of arrow 84 raises the shroud so that the light reflected off surfaces 77, 79 may be given a red tint if desired.

Switch 86 is an of/off switch and switch 88 controls the direction of rotation of the mirrors. Carrying strap 89 is optional.

Note that the bottom 71 of handle 73 is widened to enable storage of the unit in an upright configuration as shown.

A portable lantern 90 that incorporates the teachings of this invention is shown in Fig. 9. Since this embodiment is similar to the embodiment of Fig. 8, similar reference numerals are applied to parts common to both Figs. Lantern 90 includes a pair of handles 92 and couple of switches 94, 96 that were not depicted in Fig. 8; switch 94 is an emergency mode switch and switch 96 is a vertical beam reflector switch. The reflector means in this embodiment is also a vacuum-applied reflective coating; such a coating can be employed in lieu of conventional mirrors in all other embodiments as well.

A pleasure or sport boat model 100 of the novel lighting system appears in Figs. 10 and 11. A bulb and a reflector are positioned within opaque housing 101. Note the bulbous transparent housing 99 and suction cups 102 which facilitate mounting of this model on pleasure craft.

A larger, commercial version of a marine lighting system appears in Fig. 12. The same reference numerals are applied to Fig. 12 as used in Figs. 7-11 to indicate corresponding parts.

Fig. 13 shows a cylindrical sea-mounted marker buoy 104 having white, red and green reflectors, collectively denoted 106, applied thereto. Buoy 104 in Fig. 13 includes a corrosion-free shaft 108 because it is intended for use in salt water environments. Float 110 includes ballast; the numeral 112 indicates the counter-ballast, and 114 denotes a stainless steel cable that extends to a permanent anchor.

Figs. 14 and 15 show land-based pylons 116; Fig. 14 shows the pylon mounted on land and Fig. 15 shows the pylon mounted in shallow water. In all three usages, the marker is illuminated by a lamp constructed in accordance with the teachings and suggestions made herein.

Figs. 16-18 show a street lamp 120 that employs the novel mirror arrangement. The light source, including reflector and bulb, is housed in housing 124 and the reference numeral 126 indicates the motor that rotates the molded one piece plastic base 78 having reflective surfaces 77, 79. Part 130 is a clear plastic shroud and part 132 is an opaque reflector that reflects the light toward the area sought to be illuminated. 134 is a conventional photo cell timer.

Fig. 19 shows a two-storey house 140 every room of which is illuminated by a single light source 142 shown at the bottom of a light tunnel or transmission tube 144, although it should be understood that said light source could be at the top of such tube or at another preselected location. Branch light transmission tubes 146 (second floor) and 148 (first floor) carry reflected light to the various rooms of the house. The rotary reflector for the second floor is denoted 150 as a whole and the rotary reflector for the first floor is denoted 152.

Fig. 20 shows that a belt drive motor 154 may be employed to rotate reflector 152; mounting bracket 153 is also depicted. Note that a direct drive motor 158 may be employed to rotate the upper reflector 150 (Fig. 19).

Light emission prisms, collectively denoted 156, are positioned at the end of each light tunnel 146, 148, as shown in Fig. 19.

A police squad car light that incorporates the inventive teachings is shown in Figs. 21 and 22 and is denoted 160 as a whole. Motor 162, shown in Fig. 22, rotates the one piece molded base 78; the light source is housed in dome 164. Lights 166 are conventional.

A remote control pad 170, shown in Fig. 23, includes keys 172 that, when activated, control the various functions of the novel structure. For example, one key may simply activate the source of electromagnetic radiation, another key may effect rotation of the mirrors or reflectors in a first direction, another key may raise or lower a tinted shroud, another key may place the lamp in its emergency mode, and so on. Remote activation is accomplished through conventional transmitting and receiving means.

The remaining figures (24-38) show prisms of the

type having utility in connection with the structure-lighting system of Fig. 19. The prisms can also be used in lieu of mirrors and other reflecting surfaces in all other embodiments as well. A prism having four sides need rotate at only one-fourth the speed of a single-sided reflector to produce the same amount of reflected illumination. The speed of rotation is thus inversely proportional to the number of reflecting surfaces, i.e., where N = the number of reflecting surfaces, the speed of rotation required to produce an equal amount of light over an equal area at equal source intensifies is equal to 1/N.

Figures 24-27 and 30-38 represent a variety of different prism configurations for possible use in the present invention ranging from the simple triangular prisms of Figs. 24-27, to the four-sided prisms of Figs. 30-32, the tri-, tetra- and octagonal prisms of Figs. 36-38, and the complex cylindrical prisms of Figs. 33-35, each with planar reflecting surfaces.

Figures 28 and 29 represent rectangular pyramidal prisms having curved, e.g. concave, reflective surfaces as indicated by the dotted lines.

It was mentioned earlier that the light source is in axial alignment with the output shaft of the motor that rotates the mirrors or reflectors. However, another important teaching of this invention is that the lamp may be eccentrically aligned as well. Interestingly, as the source of electromagnetic radiation is offset from its axial alignment with the rotational axis of the mirrors, surrounding areas that had been illuminated fall into darkness if not otherwise illuminated. As the amount of offset increases, the angular sweep of the illuminating beam is decreased, i.e. preselected areas may be shrouded from illumination by selecting the amount of offset between the axis of symmetry of the light source and the axis of rotation of the mirrors.

It should be understood that the novel light can be portable or stationary as requirements dictate. Moreover, the axis of rotation of the mirrors need not be vertical as depicted. The axis of rotation may be horizontal or any preselected angle between the vertical and horizontal. Due to the high speed of rotation and the phenomenon known as persistence of vision, the illuminated area will appear to be continuously illuminated. The illumination will of course be achieved in the plane of the reflected beam's travel, i.e., when the axis of rotation is vertical, the beam will travel in a horizontal plane. The brightest part of the reflected light beam will always be angled ninety degrees relative to the axis of rotation of the mirrors and the two light beams will always be one hundred eighty degrees opposed to one another.

The speed of rotation of the mirrors may be preselected to as low as ten revolutions per second, and as high as one hundred fifty revolutions per second or even higher. The device operates vibration-free because it is inherently balanced, i.e., its "X" configuration is an aerodynamically optimal design. This high speed rotation is not possible in the prior art designs due to their inherent structural imbalance. The speed of rotation is so high in the novel light that no flicker is visible, i.e., the illuminated area seems to be under truly continuous illumination. Thus, even a speeding automobile is easily detected. Very high speed automobiles can escape detection under the flickering illumination of prior art lights.

The high speed of rotation also insures that each area of illumination will be brightly illuminated.

When examining the illumination of a three hundred sixty degree circular area, for example, a light meter shows that the peak intensity of light in each one degree area of illumination is the same and is substantially equal to the illumination that is provided by a fixed beam of the same intensity. A slight, but negligible loss in intensity may arise if the transparent part of the housing 28 is not perfectly clear and optically coated of if the mirror surfaces are not perfectly reflective and clean.

To achieve the same results, a single mirror would have to rotate twice as fast as the novel opposing mirrors of this invention for any given level of illumination. However, prior art mirrors, being unbalanced, cannot achieve the rotational speeds of the present invention. Theoretically, however, if prior art mirrors could reach sufficient rotational speed to achieve the unflickering, intense illumination achieved by the present device, such mirrors would require at least twice the energy input as the novel device. Thus, the ability to rotate at half the speed of a prior art lamp to provide the same quantity and quality of illumination is an important energy-saving feature of this invention.

Although the mirrors of this invention have been depicted as being flat, other configurations for such mirrors are within the scope of this invention. For example, the reflective surfaces could be convex or concave if an application were to require more diffuse or more concentrated lighting, respectively. Compound reflective surfaces are also within the scope of this invention, as are diffuse, specular, and the like and any combination thereof.

In addition, contemplated solar assisted and solar powered exterior lighting systems including marine, roads and parking applications as well as solar assisted and solar powered interior lighting systems including integrated and stand alone applications are well within the scope of this invention. These solar power applications will utilize various solar cells, panels and other collection devices.

Those skilled in the art of optics will also appreciate that prisms, crystals, lenses, optical fibers, fluids and the like could be employed to enhance light transmission, amplification and reflection and all such embellishments are within the contemplation and scope of this invention, as a matter of law.

Those of such skill will also readily appreciate that

the light source need not be restricted to the visible light region of the electromagnetic spectrum. For example, some applications may call for the "illumination" of an area by infrared or ultraviolet radiation. Other applications might even call for the reflection of radiation from the remaining regions of the spectrum, and all such usages of the inventive structure are clearly within the scope of this invention.

The light source may be of the conventional incandescent of fluorescent type, or numerous other types such as halogen, xenon, sodium vapor, neon, solar, laser, infrared and the like. Accordingly, the claims that follow refer to the light source in a generic sense, i.e. as a source of electromagnetic radiation.

Claims

1. An omnidirectional (360°) light of the kind comprising a reflector (18) mounted for rotation about an axis and having a reflective surface (22) inclined with respect to that axis, a stationary, unidirectional light source (29) positioned to direct an incident unidirectional light beam onto the reflective surface (22) for reflection by that surface in direction away from the axis of rotation, and means (44) for rotating the reflector (18) at high speed about the said axis, thereby to cause the reflected light beam to sweep a 360° arc about said axis, characterised in that the reflector (18) comprises at least one further reflective surface (24) inclined with respect to said axis but positioned relative to said first reflective surface to split the incident light beam and to direct a second beam of reflected light away from the axis of rotation of the reflector at a radial spacing from said first reflected beam, the rotation of the reflector (18) thus serving to provide two more rotating light beams each sweeping a 360° arc about said axis at radial spacings one from the other.

2. An omnidirectional (360°) light according to claim 1, characterised in that the reflector (18) comprises two oppositely directed reflective surfaces (22, 24) positioned at 180° to each other thereby to split the incident light beam into two reflected light beams at a radial spacing of 180°.

3. An omnidirectional (360°) light according to claim 1 or 2, characterised in that the reflective surfaces (22, 24) are at 45° to the axis of rotation.

4. An omnidirectional (360°) light according to any one of claims 1 - 3, characterised in that the unidirectional light source (29) is positioned on the axis of rotation of the reflector (18) thereby to direct an incident light beam onto the reflector (18) and onto the reflective surfaces (22, 24) along an axis coincident with the axis of rotation.

5. An omnidirectional (360°) light according to any one of claims 1 to 3, characterised in that the unidirectional light source (29) is positioned to one side of the axis of rotation of the reflector (18) thereby to direct an incident light beam obliquely onto the reflector (18) and onto the reflective surfaces (22, 24).

6. An omnidirectional (360°) light according to any one of claims 1 to 3, characterised in that the unidirectional light source (29) is adjustable between a first position aligned on the axis of rotation of the reflector, and a second position to one side of that axis, thereby to provide a choice between direct illumination of the reflector (18) along the axis of rotation or oblique illumination.

7. An omnidirectional (360°) light according to any one of claims 1 - 6, including an arcuate coloured translucent or opaque shroud (126,132) positioned about the axis of rotation of the reflector (18) thereby to colour, or obscure, the reflected beams over at least part of their 360° arc.

8. An omnidirectional (360°) light according to any one of claims 1 - 7, characterised in that the reflective surfaces (22, 24) are planar.

9. An omnidirectional (360°) light according to any one of claims 1 - 7, characterised in that the reflective surfaces (27, 24) are convex or concave.

10. An omnidirectional (360°) light according to claim 9, characterised in that the reflective surfaces (22, 24) compound.

11. An omnidirectional (360°) light according to claim 9, characterised in that the reflective surfaces (22, 24) are diffuse.

12. An omnidirectional (360°) light according to any one of claims 1 - 11, characterised in that the stationary light source (20, 60) is a collimated light source.

13. An omnidirectional (360°) light according to any one of claims 1 - 12, characterised in that the light source (29) provides an incident light beam having a wavelength falling within the visible region of the electromagnetic spectrum.

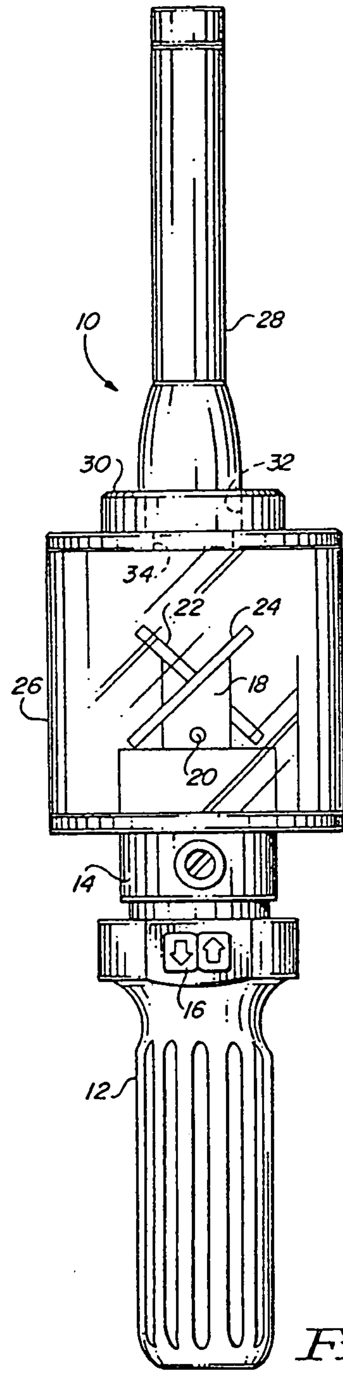
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FIG. 1

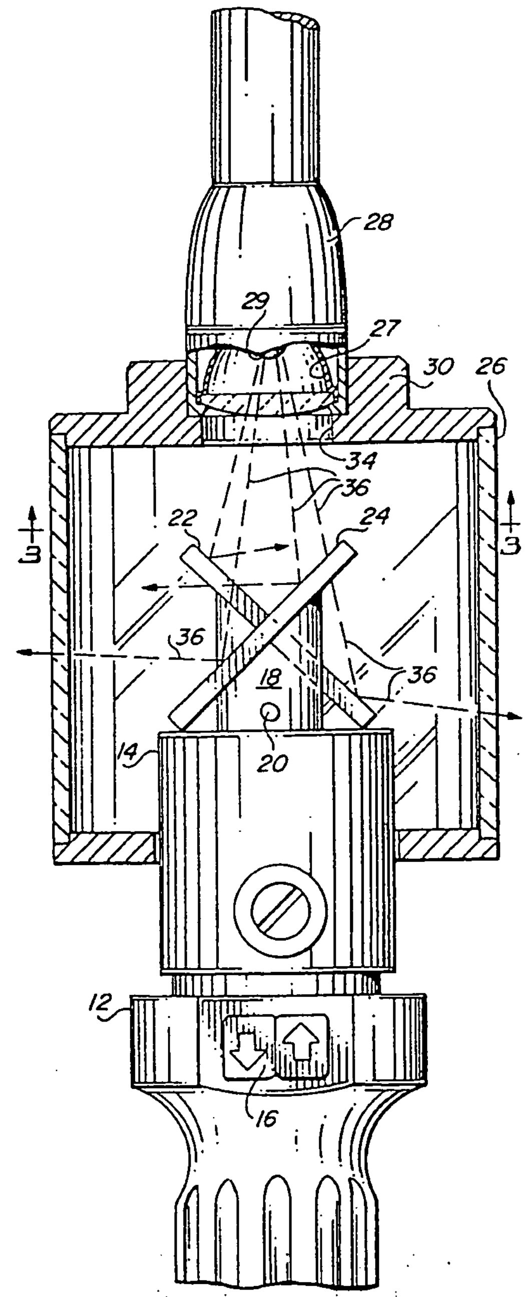
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FIG. 2

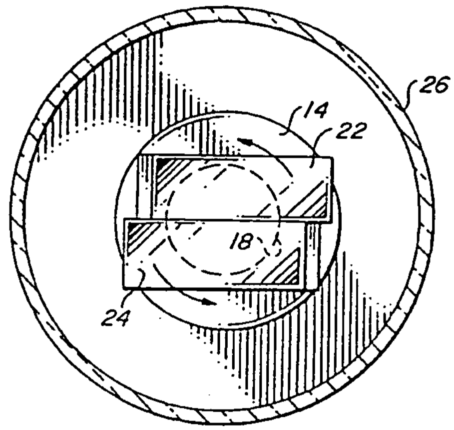

FIG. 3

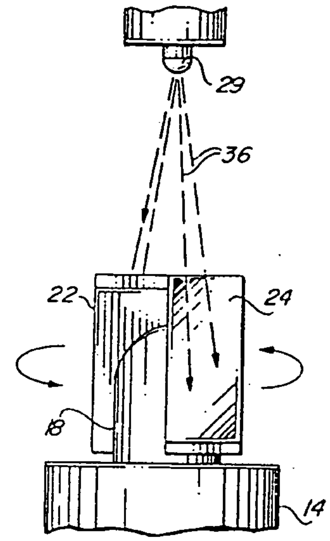

FIG. 5

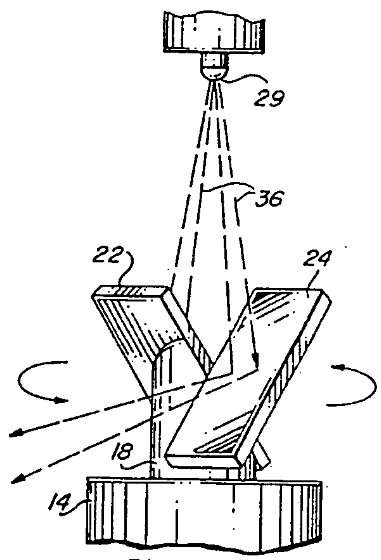

FIG. 4

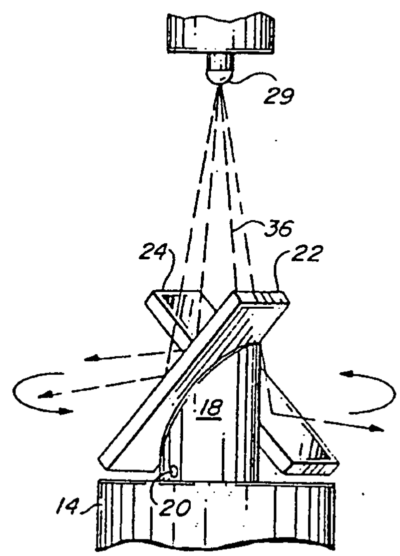

FIG. 6

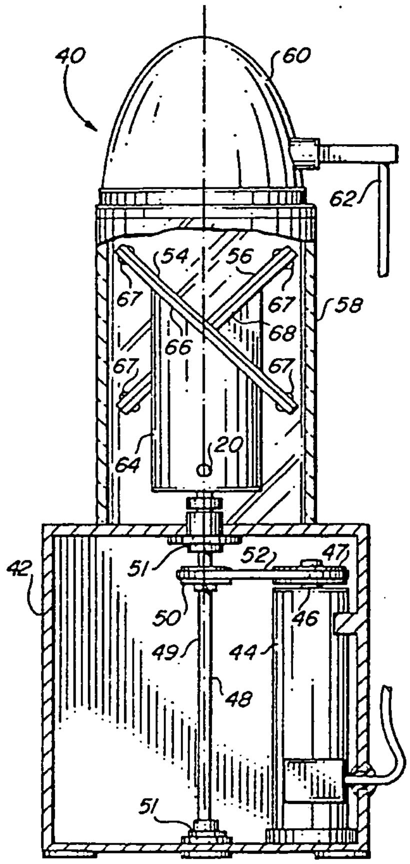
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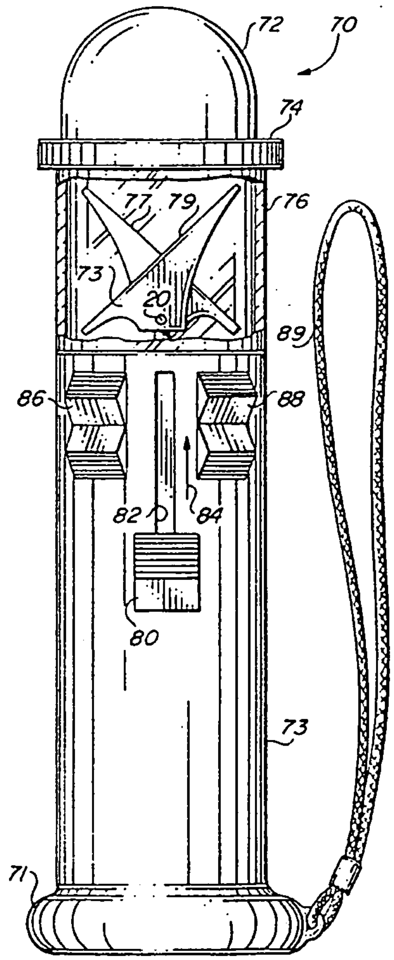
FIG. 7

FIG. 8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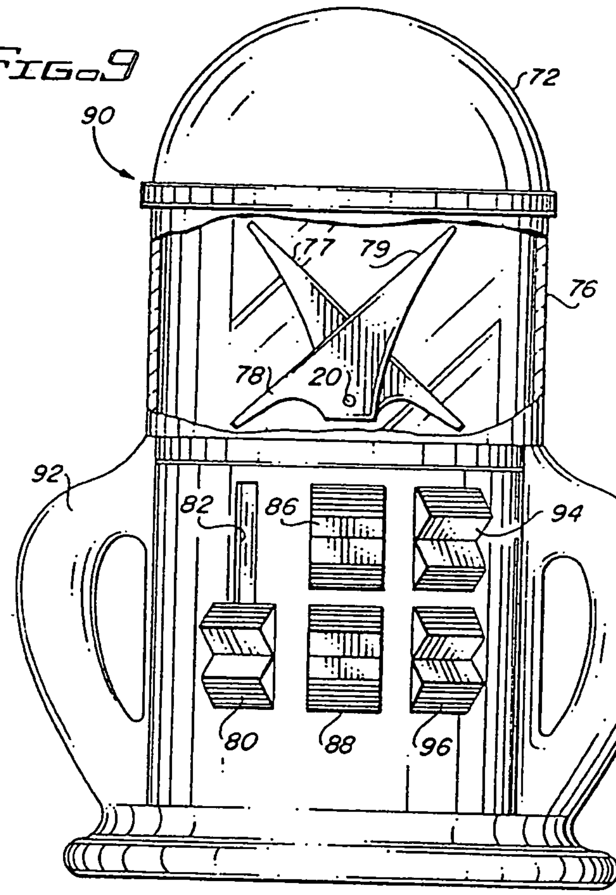

FIG. 9

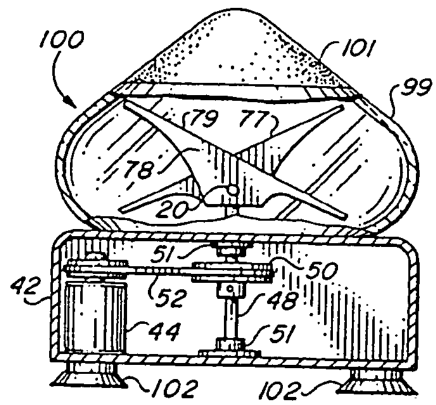

FIG. 10

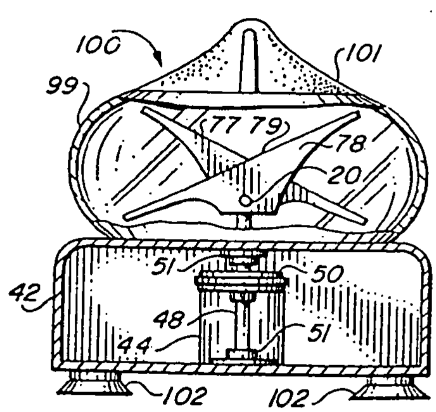

FIG. 11

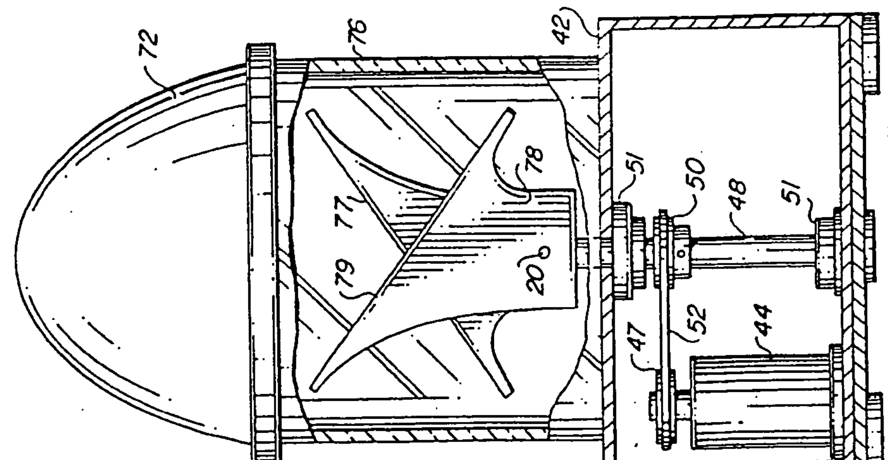

Fig. 12

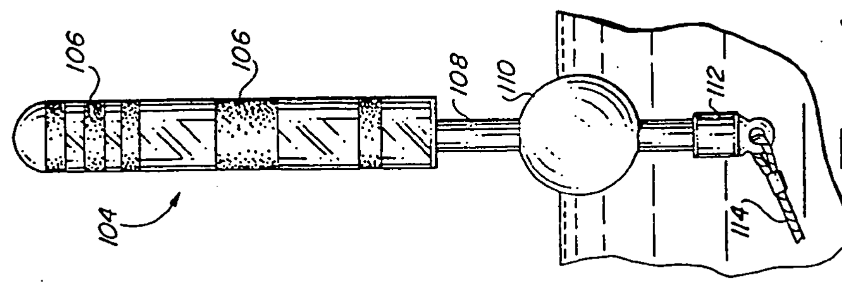

Fig. 13

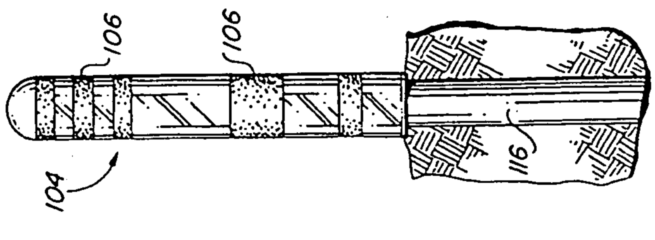

Fig. 14

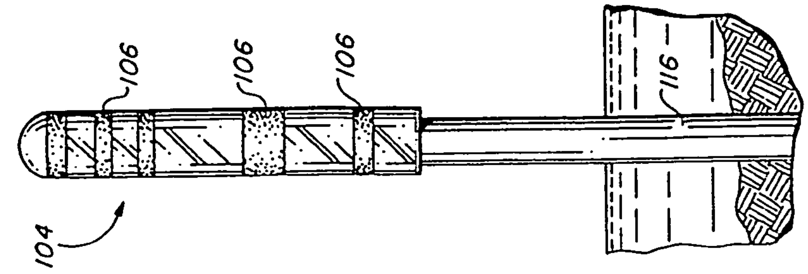

Fig. 15

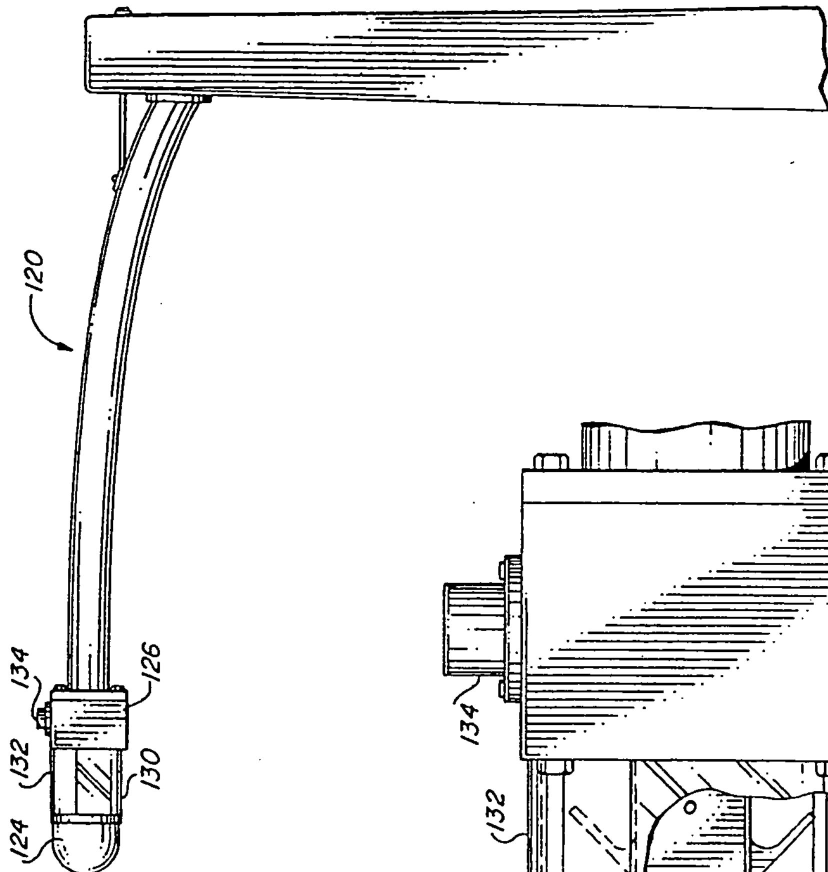

FIG. 17

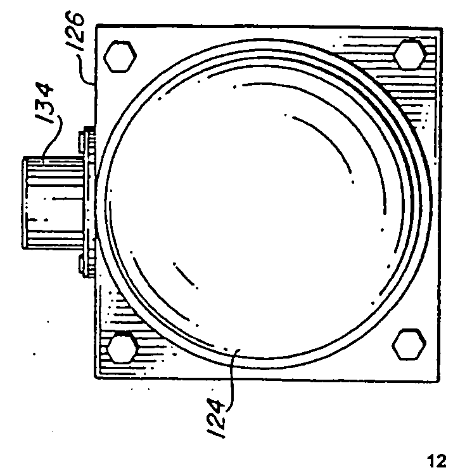

FIG. 18

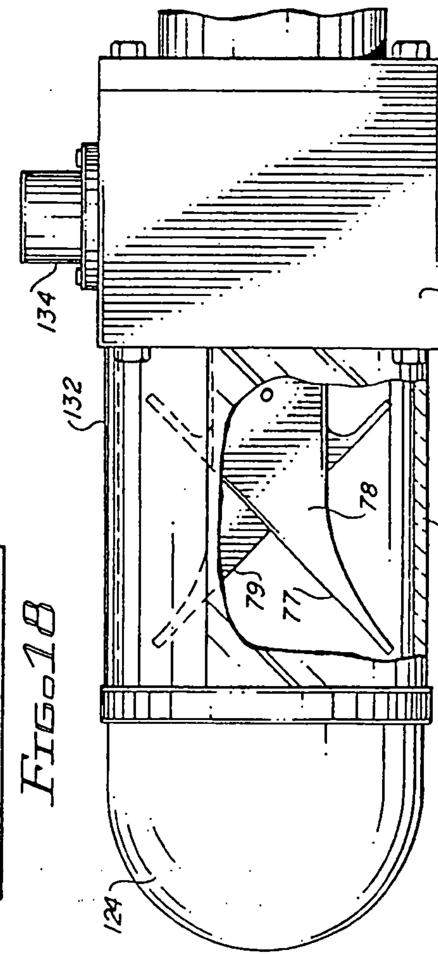

FIG. 16

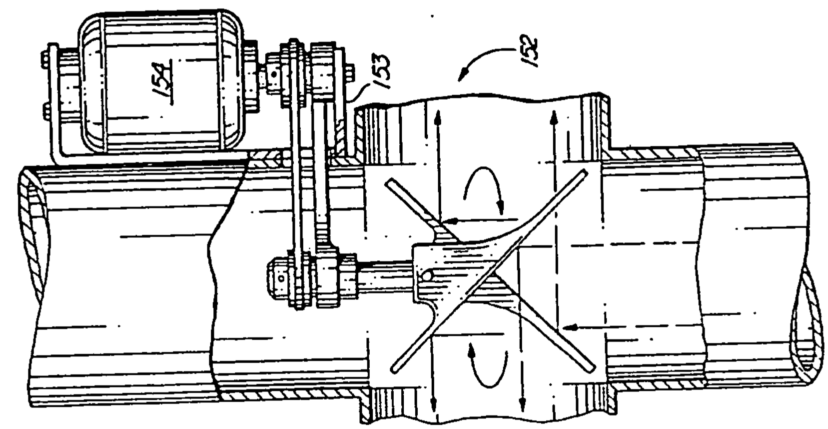

FIG. 20

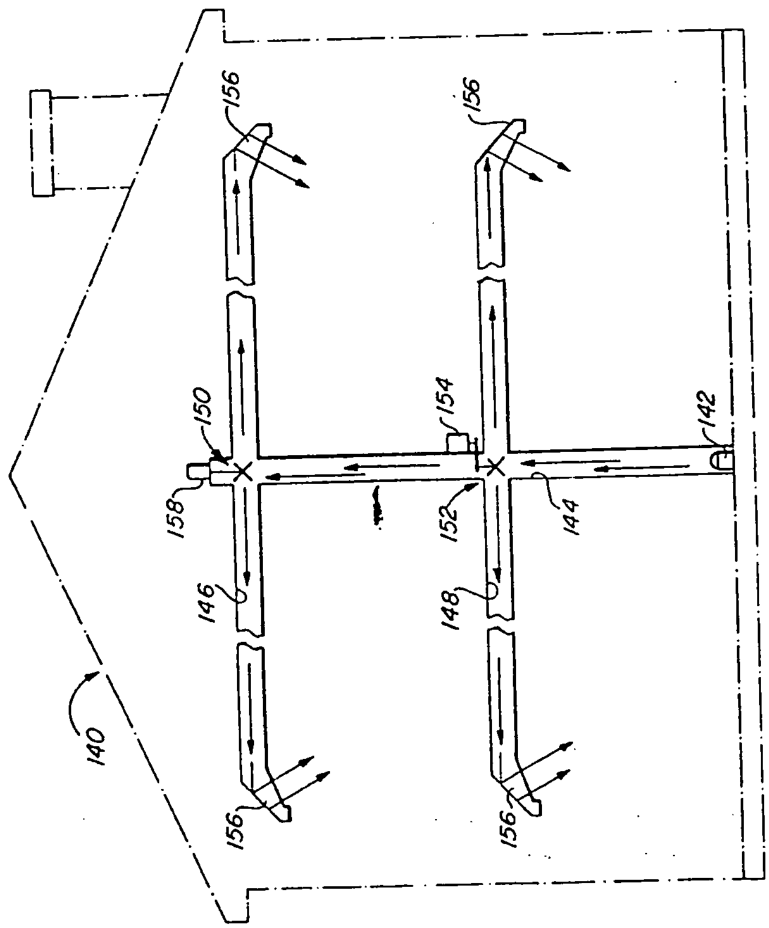

FIG. 19

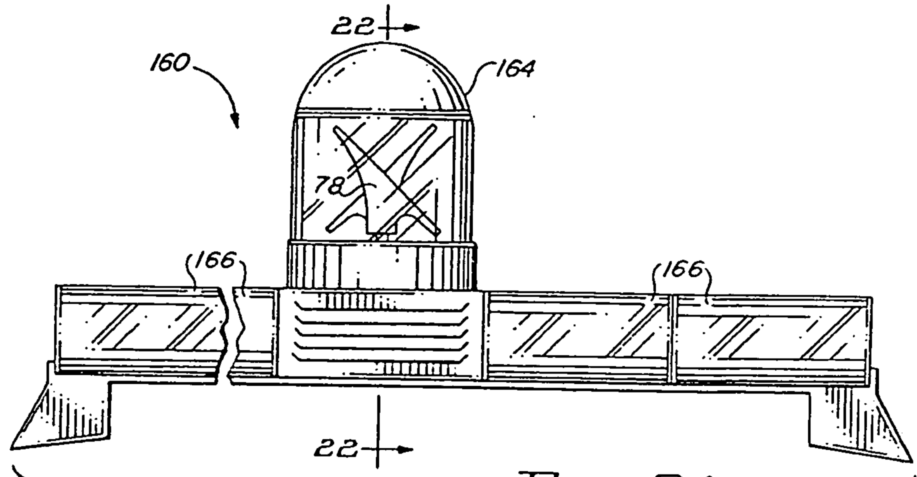

FIG. 21

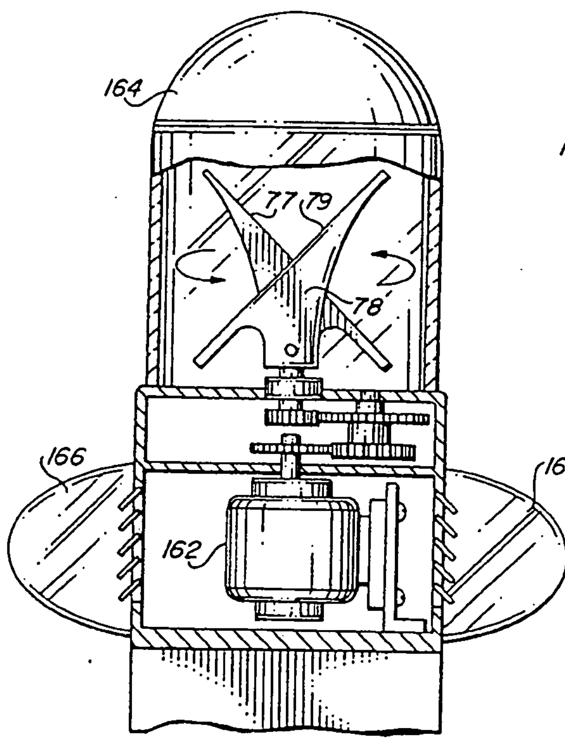

FIG. 22

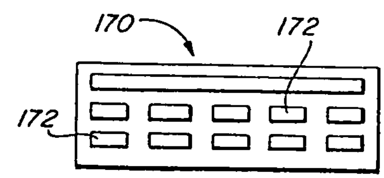

FIG. 23

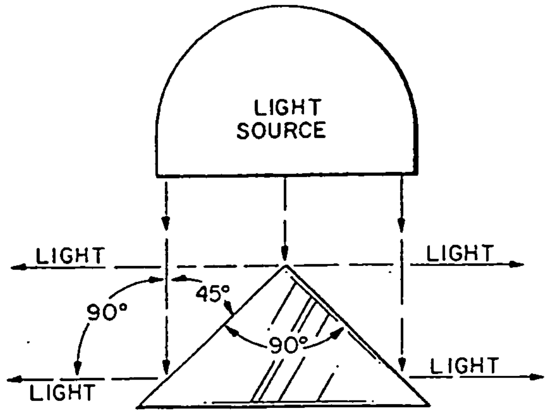

FIG. 24

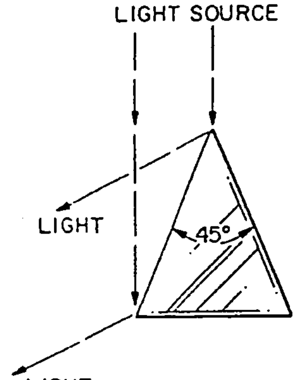

FIG. 25

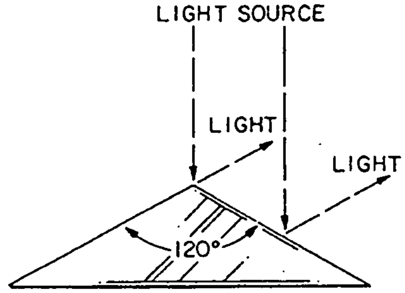

FIG. 26

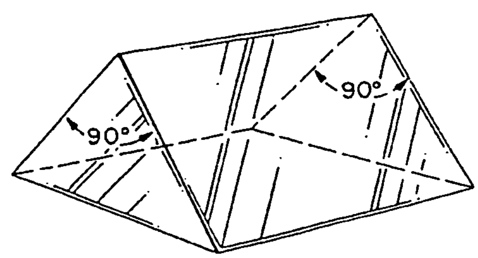

FIG. 27

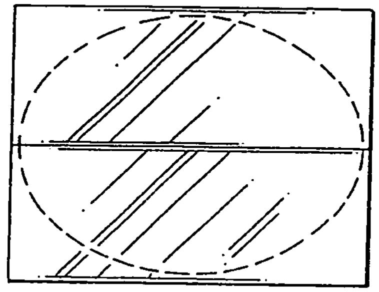

FIG. 28

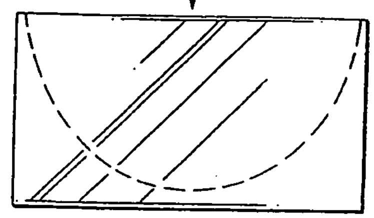

FIG. 29

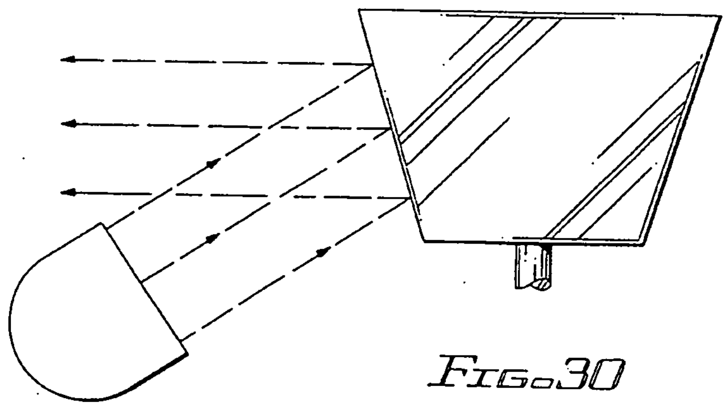

FIG. 30

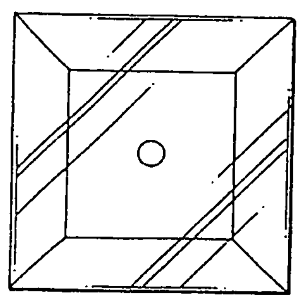

FIG. 31

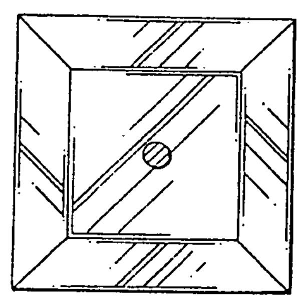

FIG. 32

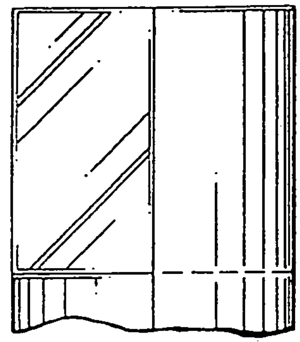

FIG. 33

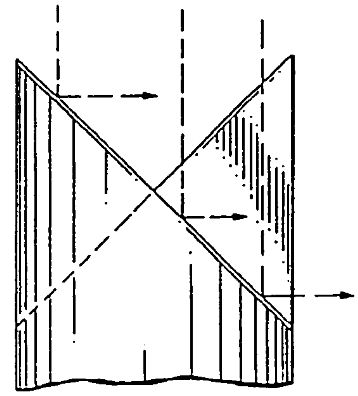

FIG. 34

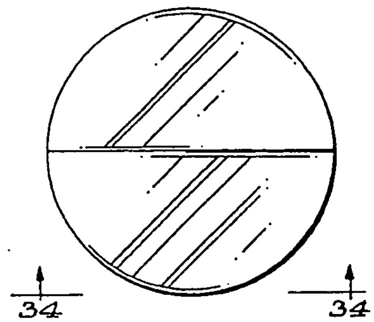

FIG. 35

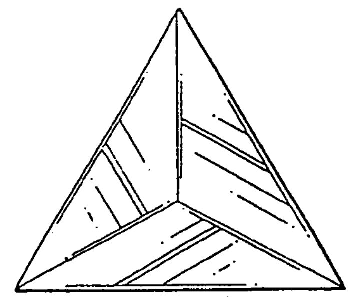

FIG. 36

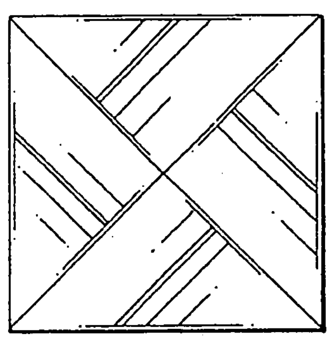

FIG. 37

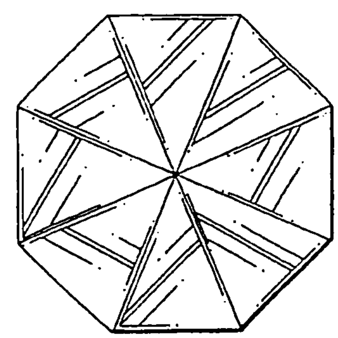

FIG. 38

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(54) **Omnidirectional light.**

(57) An omnidirectional (360°) light is provided comprising a fixed, unidirectional light source (29) (including IR and UV sources as well as visible light) providing a unidirectional incident light beam (36) incident upon two or more, oppositely directed reflective surfaces (22,24) on a rotatable reflector (18) and inclined to the incident beam, preferably at 45°, to provide two or more reflected beams, directed radially away from the axis of rotation of the reflector and radially spaced one from the other at preferably 180°. Four or more reflective surfaces may be used to provide, for example, four reflected beams at 90° to each other. The reflector (18) is rotatable at high speed about the axis of rotation by a motor to cause the reflected beams each to sweep a 360° arc about the axis of rotation, the speed of rotation being such that the light appears continuous.

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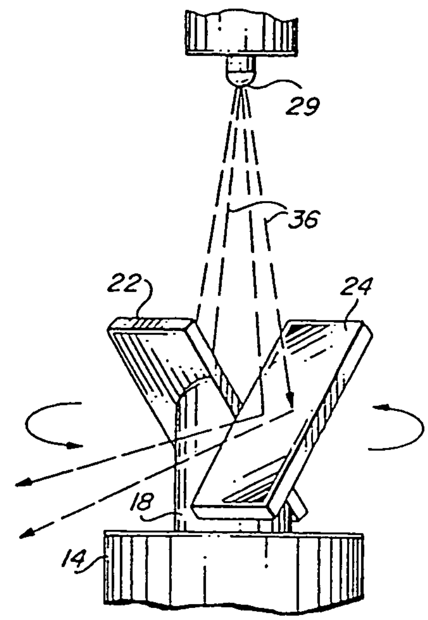

FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 6890

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	GB-A-975 583 (MALDON CAVENDISH HARLEY) * page 2, line 104 - page 3, line 15; figure 1 *	1-4,7-9, 12,13	F21Q3/00 B60Q1/26
X	US-A-2 846 663 (HEEHLER ET AL) * the whole document *	1-4,7,8, 12,13	
X	US-A-2 740 103 (GOSSWILLER) * figures 5-8 *	1-4,8,9, 12,13	
X	US-A-4 104 615 (HUNTER) * the whole document *	1-4,8, 12,13	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F21Q
B60Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 JANUARY 1992	VAN OVERBEEKE J.

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E : earlier patent document, but published on, or after the filing date
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